

**Patent claims:**

1. A biosensor circuit arrangement
  - having a substrate;
  - 5 • having a sensor element formed in or on a surface region of the substrate with a physical parameter, which can be coupled to a substance to be examined, the type of coupling having a resistive component;
  - 10 • having a calibration device formed in or on the substrate, said calibration device being set up in such a way that it can be used to at least partly compensate for an alteration of the value of the physical parameter of the sensor element.
- 15 2. The biosensor circuit arrangement as claimed in claim 1,  
in which the sensor element has an electrically conductive sensor electrode that can be coupled to the  
20 substance to be examined.
3. The biosensor circuit arrangement as claimed in claim 2,  
in which the sensor element has a measuring transistor,  
25 the gate terminal of which is coupled to the electrically conductive sensor electrode.
4. The biosensor circuit arrangement as claimed in claim 3,  
30 which has a device for detecting an electrical parameter characterizing an effected sensor event, which device can be coupled to first source/drain terminal of the measuring transistor.
- 35 5. The biosensor circuit arrangement as claimed in claim 4,  
in which the calibration device is set up in such a way that it can be used to control the electrical potential

applied to the first or a second source/drain terminal of the measuring transistor in such a way that it can set a sensor signal of the sensor element, said sensor signal being brought about by a sensor event, to a value which is independent of the value of the physical parameter of the sensor element.

6. The biosensor circuit arrangement as claimed in claim 5,  
in which the calibration device is set up in such a way that it can be used to control the electrical potential present at the first source/drain terminal of the measuring transistor.

7. The biosensor circuit arrangement as claimed in claim 6,  
in which a first electrical reference potential can be applied to the second source/drain terminal of the measuring transistor, and in which the calibration device has a calibration transistor having a first and a second source/drain terminal, which source/drain terminals are connected between the first source/drain terminal of the measuring transistor and the device for detecting an electrical parameter, and it is possible to apply to the gate terminal thereof an electrical signal such that the electrical potential which can be applied to the first source/drain terminal of the measuring transistor can be set in such a way that the alteration of the value of the physical parameter of the sensor element can at least partly be compensated for.

8. The biosensor circuit arrangement as claimed in claim 5,  
in which the calibration device is set up in such a way that it can be used to control the electrical potential present at the second source/drain terminal of the measuring transistor.

9. The biosensor circuit arrangement as claimed in claim 8,

in which the first source/drain terminal of the  
5 measuring transistor is coupled to the device for  
detecting an electrical parameter, and in which the  
calibration device has a calibration transistor having  
a first source/drain terminal, which is coupled to the  
10 second source/drain terminal of the measuring  
transistor, and a second source/drain terminal, to  
which a second electrical reference potential can be  
applied, and to the gate terminal of which it is  
possible to apply an electrical signal such that the  
15 electrical potential which can be applied to the second  
source/drain terminal of the measuring transistor can  
be set in such a way that the alteration of the value  
of the physical parameter of the sensor element can at  
least partly be compensated for.

20 10. The biosensor circuit arrangement as claimed in  
claim 8,

in which the calibration device has:

- a calibration transistor;
- a first constant-current source, which is coupled  
25 to respective second source/drain terminals of the  
measuring and calibration transistors that are  
connected in parallel with one another, for the  
provision of a predeterminable electrical current  
intensity;
- 30 • a current mirror circuit, which is coupled to  
respective first source/drain terminals of the  
measuring and calibration transistors that are  
connected in parallel with one another, and which  
is connected up in such a way that it can be used  
35 to set, for the purpose of at least partly  
compensating for the alteration of the value of  
the physical parameter, the electrical potential  
at the gate terminal of the calibration transistor

in such a way that, in the absence of a sensor event, the current flows between the two source/drain terminals of the measuring transistor and of the calibration transistor are identical.

5

11. The biosensor circuit arrangement as claimed in claim 8,

in which a third electrical reference potential is applied to the first source/drain terminal of the measuring transistor, and in which the calibration device has,

- a calibration transistor having a first and a second source/drain terminal;
- a second constant-current source, which is coupled to the respective second source/drain terminals of the measuring and calibration transistors that are connected in parallel with one another, for the provision of a predeterminable electrical current intensity;
- a third constant-current source, which can be coupled to the first source/drain terminal of the calibration transistor, for the provision of a further predeterminable electrical current intensity, which third constant-current source is connected up in such a way that it can be used to set, for the purpose of at least partly compensating for the alteration of the value of the physical parameter, the potentials that can be applied to the terminals of the transistors in such a way that, in the absence of a sensor event, the current flows between the two source/drain terminals of the measuring transistor and of the calibration transistor are identical.

12. The biosensor circuit arrangement as claimed in claim 4,

in which the calibration device is set up in such a way that it can be used to convert a sensor signal of the

sensor element, said sensor signal being brought about by a sensor event, using the principle of correlated double sampling to a value which is independent of the value of the physical parameter of the sensor element.

5

13. The biosensor circuit arrangement as claimed in claim 12,

in which a fourth electrical reference potential can be applied to a second source/drain terminal of the measuring transistor, and in which the calibration device

- 15 • has an electrical subtraction device having two inputs and an output, which output can be coupled to the device for detecting an electrical parameter, which first input is coupled to the first source/drain terminal of the measuring transistor, and which electrical subtraction device is set up in such a way that the difference between two electrical signals applied to the two inputs can be provided at its output;
- 20 • has a sample-and-hold element connected between the first source/drain terminal of the measuring transistor and the second input of the electrical subtraction device;
- 25 • is set up in such a way that
  - in a first operating state, a sensor signal dependent on the physical parameter of the sensor element can be impressed into the sample-and-hold element and can be provided to the second input of the electrical subtraction device;
  - 30 - in a second operating state, a signal which is characteristic of the physical parameter of the sensor element can be provided to the input of the electrical subtraction device;
  - 35 - a sensor signal independent of the value of the physical parameter of the sensor element can be provided at the output of the electrical

subtraction device, as a result of which the alteration of the value of the physical parameter is at least partly compensated for.

- 5 14. The biosensor circuit arrangement as claimed in one of claims 4 to 13,  
in which the electrical parameter is
- an electrical voltage or
  - an electric current.
- 10 15. The biosensor circuit arrangement as claimed in one of claims 2 to 14,  
in which the sensor electrode has one or a combination of the materials
- 15 • titanium
  - titanium nitride
  - gold and
  - platinum.
- 20 16. The biosensor circuit arrangement as claimed in one of claims 1 to 15, which has an amplifier element for amplifying a sensor signal.
- 25 17. The biosensor circuit arrangement as claimed in one of claims 1 to 16,  
which has a switching device set up in such a way that it can be used optionally to couple the sensor element to a fifth electrical reference potential or to decouple it from the latter, in order to protect the
- 30 sensor element from damage and/or in order to apply a defined electrical potential to the sensor element.
- 35 18. The biosensor circuit arrangement as claimed in one of claims 1 to 17,  
in which the substrate is a silicon substrate.
19. The biosensor circuit arrangement as claimed in one of claims 1 to 18,

in which the type of coupling between the sensor element and the liquid to be examined has a capacitive component.

5 20. A sensor array having a plurality of biosensor circuit arrangements as claimed in one of claims 1 to 19, said biosensor circuit arrangement being arranged essentially in matrix form in crossover regions of row and column lines and being connected up to the row and  
10 column lines.

21. The sensor array as claimed in claim 20,  
in which at least a portion of the biosensor circuit arrangements have a selection element - coupled to the  
15 respectively associated row line and/or column line - for selection of the respective sensor arrangement in order to detect a sensor signal of the sensor element of the selected biosensor circuit arrangement and/or in order, in the case of the selected biosensor circuit  
20 arrangement, at least partly to compensate for the alteration of the value of the physical parameter and/or in order to apply the fifth electrical potential to the sensor element of the selected biosensor circuit arrangement.

25

22. The sensor array as claimed in claim 20 or 21,  
in which at least a portion of the biosensor circuit arrangements assigned to a respective row and/or column  
line have

- 30 • a common device for detecting an electrical parameter that characterizes an effected sensor event,
- a common constant-current source,
  - a common switching device,

35 • a common reference potential,

  - a common current-voltage converter,
  - a common analog-digital converter,
  - a common current mirror,

- a common subtraction device,
- a common sample-and-hold element, and/or
- a common amplifier.

5 23. The sensor array as claimed in one of claims 20 to 22,

in which at least a portion of the row and/or column lines in each case have a device for detecting an electrical parameter that characterizes an effected  
10 sensor event, the sensor array being set up in such a way that the device for detecting an electrical parameter that is assigned to a respective row or column line can detect

- a sensor signal of precisely one sensor  
15 arrangement of the respective row or column line,
- or a sum of sensor signals of at least a portion of the sensor arrangement of the respective row or column line.

20 24. The sensor array as claimed in one of claims 20 to 23,

in which at least a portion of the column lines are coupled to a potential control device, which potential control device is set up in such a way that it holds  
25 the electrical potential of the associated column line at an essentially constant value.

25. A biosensor array having a sensor array as claimed in one of claims 20 to 24.